

Title:

Assembly of 5.5-Meter Diameter Developmental Barrel Segments for the Ares I Upper Stage

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Full scale assembly welding of Ares I Upper Stage 5.5-Meter diameter cryogenic tank barrel segments has been performed at the Marshall Space Flight Center (MSFC). One full-scale developmental article produced under the Ares 1 Upper Stage project is the Manufacturing Demonstration Article (MDA) Barrel. This presentation will focus on the welded assembly of this barrel section, and associated lessons learned.

Among the MDA articles planned on the Ares 1 Program, the Barrel was the first to be completed, primarily because the process of manufacture from piece parts (barrel panels) utilized the most mature friction stir process planned for use on the Ares US program: Conventional fixed pin Friction Stir Welding (FSW). This process is in use on other space launch systems, including the Shuttle's External Tank, the Delta IV common booster core, the Delta II, and the Atlas V rockets. The goals for the MDA Barrel development were several fold: 1) to prove out Marshall Space Flight Center's new Vertical Weld Tool for use in manufacture of cylindrical barrel sections, 2) to serve as a first run for weld qualification to a new weld specification, and 3) to provide a full size cylindrical section for downstream use in precision cleaning and Spray-on Foam Insulation development.

The progression leading into the welding of the full size barrel included sub scale panel welding, subscale cylinder welding, a full length confidence weld, and finally, the 3 seamed MDA barrel processing. Lessons learned on this MDA program have been carried forward into the production tooling for the Ares 1 US Program, and in the use of the MSFC VWT in processing other large scale hardware, including two 8.4 meter diameter Shuttle External Tank barrel sections that are currently being used in structural analysis to validate shell buckling models.